DECEMBER, 1948
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The INSTITUTE Spokesman

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Official Publication of NATIONAL LUBRICATING GREASE INSTITUTE

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Check the name . . . be sure it's AERO* BRAND . . . the name that specifies metallic soaps of exceptional purity and unprecedented uniformity. Cyanamid's new process, modern equipment, now in full-scale operation under meticulous production control from raw material to quality-sealed packaging in multi-wall paper bags, assures top quality at all times.

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Foote Vice-Pres. Abroad On Sales-Research Trip

Mr. Gordon H. Chambers, Foote Mineral Company Vice-President, flew from New York on October 30, 1948, for an extended trip to Scandinavia and Western Europe. He will contact manufacturers and processors of Lithium and other specialty minerals, and while his primary interest will be sales, Mr. Chambers will also investigate and report on all technical advancements developed since the war.

Mr. Chambers, a University of Pennsylvania graduate, served as civilian consultant to the WPB during the early days of the war—leaving this to accept a Captain's commission in the Army. He rose rapidly in rank to Colonel (Ordnance) and was assigned to Army Intelligence in France. Mr. Chambers joined Foote Mineral Company in 1928. This is Mr. Chambers' second European trip for Foote since the war.

J. P. Moran Promoted to Asst. Genl. Sales Manager Of Inland Steel Container

J. P. "Pat" Moran, since 1943 Branch Manager of New Orleans Plant, has been advanced to Assistant General Sales Manager of the Inland Steel Container Company. He will assume this position in the main offices at Chicago, along with J. Doyle Moore who, two years ago, became Assistant General Sales Manager and will remain in that capacity.

Announcement of the additional position in the Sales Department is made by Gordon D. Zuck, General Manager of Sales, as a part of their sales expansion program. The company manufactures a complete line of steel drums and pails at its plants in Chicago, Jersey City and New Orleans. The New Orleans Plant also manufactures Comforteer Gas Space Heaters.

Mr. Moran started with the company in 1927 in the Order Department. In 1934 he became one of the Chicago territory salesmen and was appointed Chicago City Sales Manager in 1936. He held that position until he went to New Orleans as Branch Manager in 1943. One of his duties in his new position will be the supervision of sales in the southern territory.

Season's Greetings from

The INSTITUTE SPOKESMAN

Published monthly by

THE NATIONAL LUBRICATING GREASE INSTITUTE

HARRY F. BENNETTS .... *Editor*

4638 Millcreek Parkway

Kansas City 2, Mo.

25 Per Cent Of Oil Firms' Sales From Farm Market

Potential business for oil companies on America's farms is pointed up in "Farm Facts and Figures" released today by The Chek-Chart Corporation.

The Chicago company, cooperating with the editors of "Implement and Tractor", have provided an overall Farm information service for the oil industry on a county by county breakdown of tractors, passenger cars and motor trucks as well as other essential farm statistics.

United States totals show just under 5,000,000 passenger automobiles on the nation's farms. Motor trucks add approximately 2,200,000 to the potential users of oil products. Tractors total well over three million.

The farm market has been estimated at twenty-five percent of the oil industry's oil and grease sales. The Chek-Chart publication is designed to assist in framing quotas for bulk plants, commission agents and tank truck salesmen located in farm areas.

ABOUT THE COVER PICTURE

"Precision" Corrosion Test Humidity Cabinet

For Army-Navy Aeronautical Standard Spec. No. AN-H-31

The "Precision" Corrosion Test Humidity Cabinet produces a moisture saturated atmosphere with continuous condensation on the test specimens and is used for testing corrosion of materials intended as corrision preventives.

Although this cabinet was primarily designed for Army-Navy Aeronautical Standard Specification No. AN-H-31, it may also be used for other tests where it is desired to test samples under extreme temperature-humidity conditions.

The inside working chamber is 28" cubed with tinned copper walls. Exterior walls are plywood. Top is hinged. A revolving stage specimen rack accommodates 33 test panels. It is motor-driven and revolves 1/3 R.P.M. Cabinet is electrically heated, 1,100 watts, and thermostatically controlled from room temperature to 150° F., plus or minus 2°. It is equipped with air disperser and flow gauge for metering the air.

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New Lithium Automotive Lubricating Grease

Here's the answer to year-round customer pull . . . more sales . . . steady profits. LUBE-LITH, the amazing All-Weather, Multi-Purpose Lithium base Lubricating Grease, has numerous advantages.

LUBE-LITH has high water and heat resistance, unusual stability, yet pumps readily at temperatures as low as zero. It lubricates perfectly under all driving conditions, winter and summer.

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Please forward full information on new Lube-Lith today. No obligation.

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City.......... Zone...... State..........

MULTI-PURPOSE
Automotive Grease

by H. M. FRASER, International Lubricant Corp.
F. W. SPOONER, Shell Oil Co., Inc.

As automobiles, trucks and buses have progressed to become faster, safer, more powerful and dependable, the petroleum industry has kept pace by developing better lubricants. As the builder of automotive equipment has widened his use of improved alloys and other new materials, the progressive grease manufacturer has adopted new and improved metallic bases, fats and oils.

Until recent years, it was necessary to use three or more of the different greases then available to lubricate effectively a car, truck or bus. Such greases were normally based on calcium, aluminum and sodium soaps. These greases have certain limitations. For instance, sodium greases are not satisfactory for the lubrication of water pumps containing compression type packing because of their solubility in heated water. Calcium and aluminum greases are not satisfactory for the lubrication of wheel bearings or where heat resistant greases are necessary.

The accelerated development of all lubricants which was brought about by the stringent requirements of war material brought to light the possibility of new metallic bases for grease manufacture. These were strontium, barium and lithium. Greases made from these types of soaps were found to combine high melting points, water resistance, and good mechanical stability.

Our laboratories have been engaged in research and development work on a particular type of lithium grease which would possess all the properties required for the satisfactory lubrication of automotive equipment. The impetus for the development of such a grease, i.e., a multi-purpose automotive grease, was that it would have advantages to both the service station and ultimate consumer over the use of several specialized greases. Some of these advantages are:

1. Lower inventory
2. Less dispensing equipment
3. Eliminate misapplications
4. Less time for lubricating a vehicle.

An appreciation of the required properties of a lubricating grease to be used for all grease lubricated units of automotive vehicles entails a review of what operating conditions prevail for each of these units. Table I lists these units and describes briefly the operating features which are pertinent to their lubrication.

The frequency of replenishment of grease is also pertinent. Front wheel bearings and some universal joints must be disassembled in order to apply new grease. This procedure is not generally undertaken until the vehicle has traveled a minimum of 5,000 miles which may cover a period of a year or more. Many trucks and buses are operated until brake linings are renewed before the lubrication of front wheel bearings is given attention. Other units which are lubricated by means of pressure gun fittings will be lubricated at best no more frequently than the length of time that is required for the vehicle to be driven 1,000 miles or more.

The methods of applying automotive greases and the mechanical de-

Mr. H. M. Fraser

For the past few years H. M. Fraser of the International Lubricant Corporation has devoted his time primarily to the development, testing and manufacture of a new Lithium Multi-Purpose Grease.

Mr. Fraser has been with International since 1929 when he assumed the position of Vice President in charge of Production and Research.

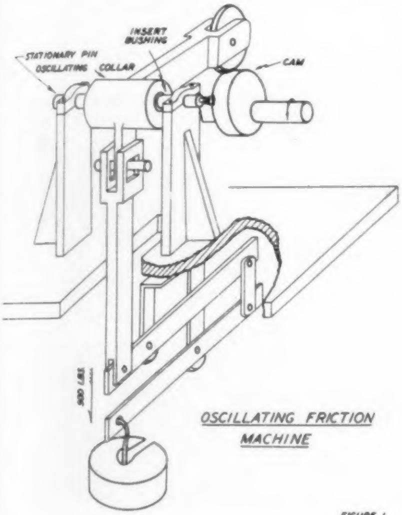
In 1920 he was graduated from Purdue University with a B. S. degree in Chemical Engineering. Mr. Fraser's first job was with the Worthington Pump and Machinery Corporation in Buffalo, New York, where he completed their factory, engineering and sales course.

TABLE I

Unit	Motion	Operating Condition
Shackles and other Movable Spring and Chassis Connections	Oscillatory—Some through small arcs	Exposed to water and dust. Poor mechanical sealing of lubricated areas. Subject to shock loading.
King Pins	Oscillatory	Exposed to water and dust.
Steering Linkages	Oscillatory	Exposed to water and dust. Poor mechanical sealing of lubricated areas.
Universal Joints	Oscillatory—Constant vibration	Protected—good sealing.
Wheel Bearings	Constant rotation	Protected. Constant working of grease under load. Subject to heat from brakes and tires.
Water Pumps (grease lubricated)	Constant rotation	Possible constant contact with heated water and anti-freeze.
Pedal Shafts	Infrequent, Oscillatory	Light load.
Pilot Bearings, Clutch Release Bearings, Propeller Shaft Bearing	Rotation	Protected. Light loading.

vices used for such application must also be considered. Except for those units which are hand-packed, the grease is applied by means of air-actuated power guns or else by means of manually-operated lever guns. The requirements of these devices necessitate that the grease be of a proper consistency and viscosity so that it may be readily dispensed through these devices at all temperatures which may be normally encountered. This entails that the dispensability of the grease be such that it can be readily handled at temperatures which may occasionally be lower than freezing.

An appreciation of different operating conditions, units to be lubricated, the amount of service automotive grease is expected to give, and the mechanical limitations of the devices used for their application allow a statement of the principal



OSCILLATING FRICTION MACHINE

FIGURE 1

properties which are required of a multi-purpose automotive grease. They are as follows:

1. MECHANICAL STABILITY

The grease must resist the effects of mechanical working or shearing under load so that it will not separate or become so soft as to run out of or be easily displaced from points to be lubricated. This requirement is at least as important for those units which are more nearly completely enclosed (wheel bearings, universal joints, propeller shaft bearings) as it is for those units which provide a limited mechanical sealing of the lubricant (shackles, steering linkages, king pins) because the grease in order to perform properly must stay in these moving parts for extended periods of time under conditions of shock loads and rotating or oscillating motion.

2. WATER RESISTANCE

The grease must be resistant to the action of water so that it will not be removed from points exposed to water which may be splashed upon them or, in the extreme, under conditions which allow the total immersion of the unit. The grease must also protect metallic parts from rusting.

3. RHEOLOGICAL PROPERTIES

The consistency and viscosity characteristics in relation to temperature must be such that at low temperatures the grease will be dispensed satisfactorily and not impart high torque in mechanisms and at the highest operating temperatures will provide satisfactory lubrication and retention.

4. CHEMICAL STABILITY

The grease must be of such a nature chemically that it will not be readily oxidized over the period of time that it is expected to perform its duty of lubrication.

A grease has been developed which satisfactorily meets the requirements of a multi-purpose automotive grease and which is now being marketed extensively in this country. The grease is of a No. 2 consistency and contains lithium soap or twelve hydroxy stearic acids. This type of lubricant and its present method of manufacture is covered by patents. This type of lithium soap base results in a grease having the high ASTM dropping point and water resistance characteristics of other types of lithium soap greases, and imparts good mechanical stability. It undergoes no major phase changes up to approximately 350°F., and, hence, is suitable for lubrication over a wide range of temperatures. The data and comments about the features of a multi-purpose automotive grease which follow in this paper will be confined to this particular lithium grease.

There are many machines in research laboratories for testing the mechanical stability of a grease, that is, its ability to withstand mechanical working without softening unduly, oxidizing, or separating. Unfortunately, no single device has been developed which can be used to predict this feature of a grease when used in the different units or under the various operating conditions encountered in automotive grease lubrication. Data obtained using four machines will be mentioned in this paper. These machines are:

1. ILC Oscillating Friction Machine.
2. Shell Rolling Apparatus.
3. CRC Wheel Bearing Tester.
4. ASTM Mechanical Worker.

The majority of grease lubricated units on automotive equipment oscillate rather than rotate. Much of this oscillation is through arcs of less than 15°. Oscillation under load provides no motion which tends to feed grease into areas in contact. Rather it tends to continually force grease away from loaded areas so that the ability of a grease to adhere to metal as well as not softening in

(Continued to page 10)

Mr. F. W. Spooner

Born in Grand Rapids, Michigan, F. W. Spooner attended Purdue and Cornell Universities. He entered the employ of the Shell Oil Company, Incorporated, in 1933 upon graduation as a mechanical engineer from Cornell.

After six years with that corporation in Indiana and Missouri as a Lubrication Engineer, Mr. Spooner was transferred to the New York Head Office of Shell's Lubricants Department. During four war years he served as a reserve officer in the Navy doing production engineering at the Navy operated torpedo plant located at Newport, Rhode Island. He is now in the Head Office with Shell as staff engineer, handling matters concerned with automotive and industrial grease lubrication.

Multi-Purpose Automotive Grease

(Continued from page 9)

service, oxidize, or be readily displaced are features necessary for such operation.

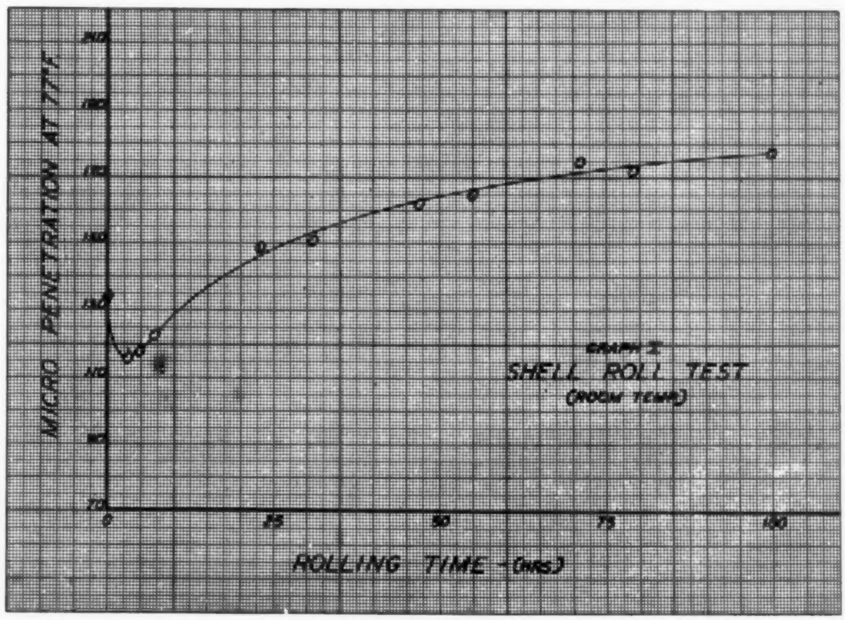
It has not been proved that greases which perform satisfactorily in bearings that rotate completely will necessarily perform well in units where the motion is limited to oscillation. It is necessary, therefore, to use testing units which employ oscillatory motion under controlled conditions in evaluating the ability of a grease to perform satisfactorily in such service. A testing device has been developed by International Lubricant Corporation known as their "Oscillating Friction Machine" which simulates under accelerated conditions the action to which greases are subjected in shackles, king pins, stearing linkages and other movable chassis connections. The machine tests the performance of a grease when lubricating a sleeve bearing which is oscillated through an arc of 15° and is operated at 350 cycles per minute. The bearing pins (3/4"d.x2") used in this test device are steel, and the bushings are brass. The loading of the bearings is by means of a weighted lever arm which gives a dead weight of 500 pounds, and the oscillating motion is designed to be similar to that encountered in the operation of a shackle or an A-frame connection on the chassis of an automobile. Figure I gives a rough outline of this test apparatus. This sketch is incomplete in that it does not show the coil spring which holds the cam follower to the cam nor the thermocouple connected to the bearing which allows a constant recording of temperatures induced within the bearing.

Oscillating friction tests on this device consume a period of days to weeks. When lubrication begins to fail, a sharply rising increase in temperature is noted on the temperature recording chart. Many tests have shown that when the bearing temperature reaches 150°F., metal-to-metal friction exists and metal pick-up has become excessive. When bearings fail, they are usually frozen, and considerable force is necessary to remove the pin from the bushing. One can observe evidence of lack of lubrication and fretting of the bearing on the top and upper sides, which are the loaded area, and grease oxidation products on the bottom of the bearing.

A considerable amount of test work has been carried out using this machine. Reproducibility is good, but as yet there are no definite claims made as to interpretation of data. We may say though that greases made from more highly refined oils and containing oxidation inhibitors show much longer life than greases of similar consistency, the same soap base but made with conventionally refined oils and containing no inhibitors. The lithium multi-purpose automotive grease will operate about 320 hours, whereas some of our con-

ventional automotive greases fail between 90 to 150 hours.

The Shell Rolling Apparatus has been described at a previous NLGI meeting. This device has been found useful in measuring the tendency of a lubricating grease to liquefy in service. It consists essentially of a weighted solid roller which is rolled freely inside an enclosed cylinder. A measured quantity of grease, 90 grams, is placed in the cylinder which is rotated continuously at a 160 rpm. The ability of the grease under consideration to withstand the severe kneading which results is measured by recording the original micro penetration of the grease and that which results from this type of mechanical working. Graph I illustrates the type of data obtained



using this device and also shows the exceptional mechanical stability of the lithium grease under consideration.

The CRC Wheel Bearing Tester described in detail in the Army Ordnance Department's Specification AXS-1574 is accepted by some as giving definite indications of the ability of greases to perform in automotive wheel bearings. All of our tests on this machine show that the lithium multi-purpose automotive grease passes all requirements prescribed by this test. When this same test device was operated under more stringent conditions of speed (535 rmp.) and spindle temperature (280°.), leakage from the bearing to the cup was only from 4 to 5 grams and only an acceptable amount of grease flow was experienced from the hub and spindle. Prolonged tests (longer than the prescribed six hour runs) were conducted with this apparatus. Standard temperature and speeds were used but the test was run for ten hours a day for ten days. The grease performed for the 100 hours with no more than three to five gram leakage, no discoloration of bearing parts, and no appreciable oxidation of the grease. Lubrication was judged to be entirely satisfactory.

The ASTM Mechanical Worker for want of any better standard device is used by our own laboratory and others for testing greases. This report ventures no interpretation of the test results obtained with this apparatus. Graph II, however, confirms the good mechanical stability of this grease as shown by other test devices.

Pumpability tests with standard commercial grease pumps are subject to so many variables that accurate data are difficult to obtain. This is complicated by the fact that no standard procedure has been adopted. Our method of running pumpability tests is as follows:

A 100-pound drum of the grease to be tested is placed in the cold room which has already been brought down to the test temperature. After the temperature of the grease reaches the test temperature a Lincoln Model 917 Gun is placed in the grease and pumped until the gun is cleared of all foreign

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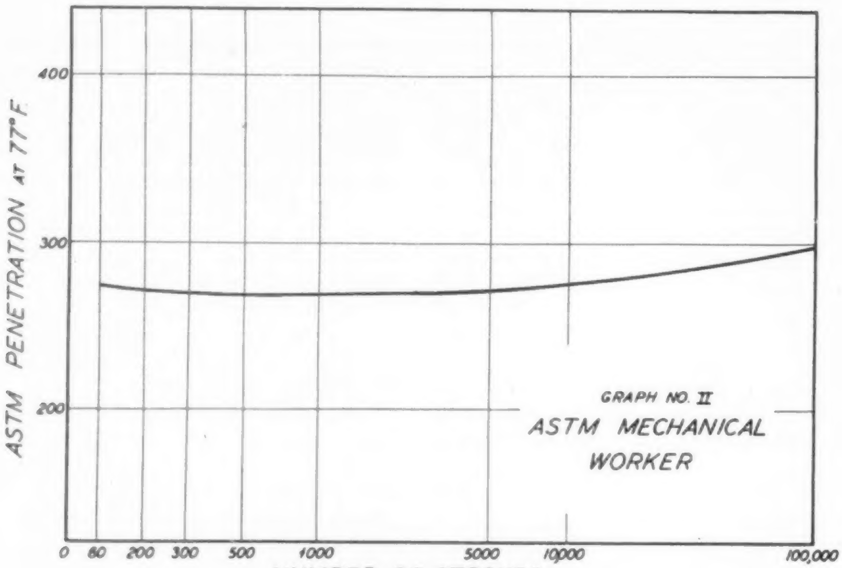


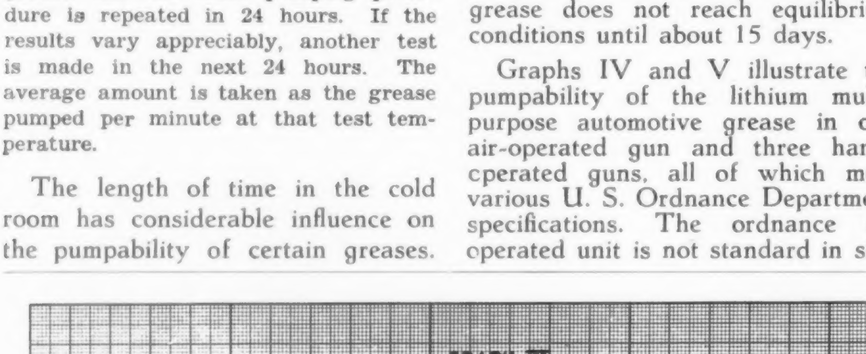
Multi-Purpose Automotive Grease

(Continued from page 11)

grease remaining from any previous test. The gun remains in the grease for 24 hours and the grease is then pumped continuously for 30 minutes. The output is weighed and the amount per minute is computed. The gun is allowed to remain undisturbed in the grease and the same pumping procedure is repeated in 24 hours. If the results vary appreciably, another test is made in the next 24 hours. The average amount is taken as the grease pumped per minute at that test temperature.

The length of time in the cold room has considerable influence on the pumpability of certain greases. When the test is conducted at 0°F. in the cold room, the temperature of a 100-pound drum of grease reaches 0° in about three days. The grease, however, does not reach its minimum pumpability until some time later. Graph III indicates that the amount of grease pumped per minute vs. days in the cold room shows that the pumpability of this particular lithium grease does not reach equilibrium conditions until about 15 days.

Graphs IV and V illustrate the pumpability of the lithium multi-purpose automotive grease in one air-operated gun and three hand-operated guns, all of which meet various U. S. Ordnance Department specifications. The ordnance air operated unit is not standard in size



so these tests data would not conform to the pumping tests described above.

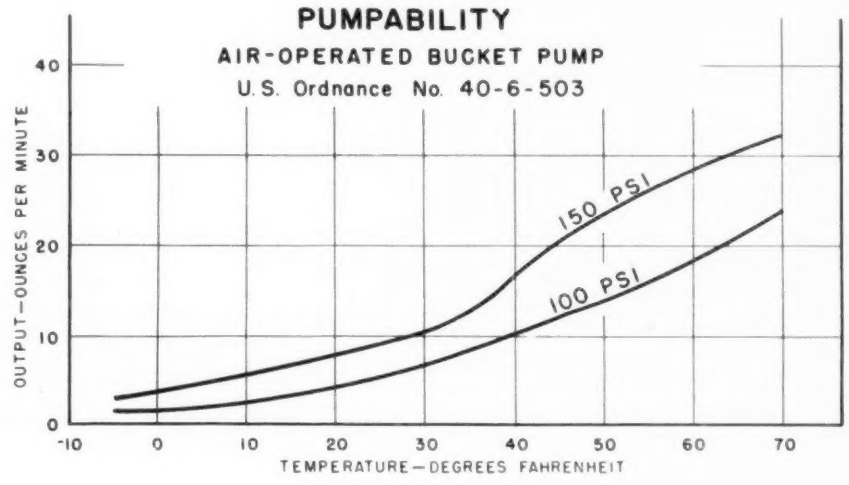
Realizing that all laboratory testing devices known to our company give at the best only indications of the suitability of greases for various applications, a rather careful and extensive field test of the performance of this lithium multi-purpose automotive grease was conducted before the sale of this product was considered. Three fleets of automotive vehicles, each comprised of heavy tractor and trailer trucks, straight trucks, light pick-up trucks, and passenger vehicles, were used for this test. The vehicles were not new and no special attention was given them before starting the test, except to replace any bearings or assemblies that had obviously passed their useful stage.

These three fleets were operated for one year in three sections of the country, which included New England, the Middle West, and the Southwest. These areas allowed operation under a considerable range of climatic conditions. Cold winter weather, hot dry summers, as well as rain, slush, and snow were encountered.

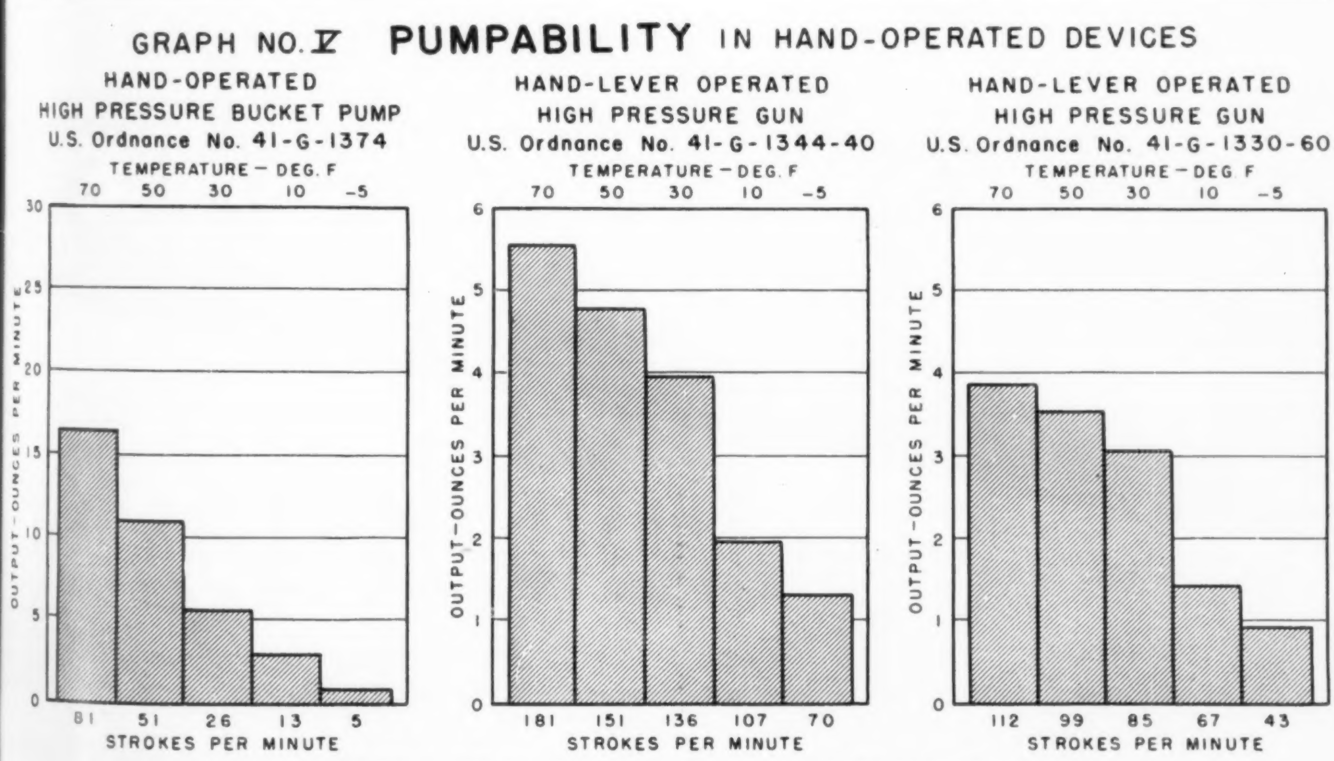
The lithium multi-purpose automotive grease was used in all grease-lubricated units with the exception of the hand-packed wheel bearings on the right side of all vehicles. Wheel bearing greases of known operating ability were used on this side of the vehicles in order to allow a performance comparison.

Relubrication of all points was carried out at normal intervals with the exception of the wheel bearings on the trucks. These were allowed to run for extended mileages covering the entire test period.

The records maintained during the test and a final careful inspection indicated that the lithium multi-purpose grease performed satisfactorily in every manner. The grease in wheel bearings of the trucks was in excellent condition and showed no appreciable change in consistency, texture, and no evidence of oxidation. Some of the other greases used for comparison did show evidence of deterioration. It is encouraging that these field tests substantiated the tentative conclusions drawn from preliminary laboratory work.



GRAPH NO. IV



APPROXIMATELY THE SAME PUMPING EFFORT WAS USED IN EACH INSTANCE

Technical Committee Column

CHAIRMAN T. G. ROEHNER, DIRECTOR OF THE TECHNICAL SERVICE DEPARTMENT, SOCONY-VACUUM LABORATORIES.

- **ORGANIZE NEW SUBCOMMITTEES**
- **NLGI LIME SPECIFICATIONS ARE POLLED**
- **DISPENSING EQUIPMENT PANEL FINDS SLUMPABILITY A MAJOR FACTOR**

The Annual Meeting of the Technical Committee in Chicago on October 13th was attended by 92 members and visitors. Most of the morning session was spent on a review of the activities of other technical groups working on the development of grease test methods. This review demonstrated that grease evaluation investigations are receiving more attention than ever before. The number and range of projects was considered by the Committee to adequately cover current problems and it was decided that in the interest of avoiding duplication of effort, the NLGI Technical Committee would not undertake any new projects involving grease laboratory test methods. It was pointed out that all of the Technical Committees already have included in their memberships individuals who are also active within the NLGI Technical organization. It was the consensus of the meeting that continued support should be given to the ABEC-NLGI Cooperative Committee on Grease Test Methods and, furthermore, that the membership thereof should be commended for the good work done to date.

Most of the afternoon sessions was devoted to new business. The outcome of the discussions was a decision to set up a number of new Subcommittees. These will be covered in detail in future issues of this column as organization is completed and they become active. In the meantime, the following information may be of interest.

1. NLGI CLASSIFICATION FOR GREASES—All proposals to revise the present classification would be referred to this Subcommittee for study. One of its major responsibilities would be to keep the classification in tune with progress in the industry. Adoption of this project was stimulated by the amount of interest expressed in multi-purpose greases. The reported performance records of those greases tend to indicate that some simplification of the present list may be possible.

2. EDITORIAL SUBCOMMITTEE—This group would review all technical papers before publication in The Institute Spokesman.

3. This Subcommittee does not even have a tentative title. It would be assigned the problem of obtaining papers for publication in The Institute Spokesman, in addition to those which are presented at the annual meeting. Arrangements for obtaining an abstract or bibliography service would also be included in its scope of activities.

4. MANUFACTURE ENGINEERING PROBLEMS SUBCOMMITTEE—This group would undertake a study of the advisability of establishing projects for obtaining fundamental information which would assist in answering engineering problems frequently encountered in the manufacture of lubricating greases. As examples, mention was made of pumps and filters and their operation.

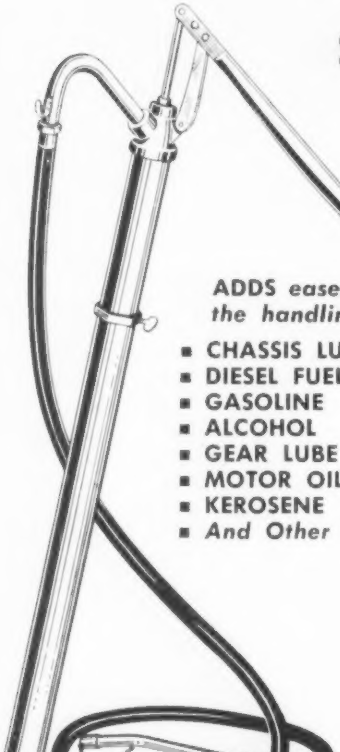
Since the meeting, and in accordance with action agreed to then, a poll is being conducted to determine whether the Committee regards as satisfactory the specifications proposed by ASTM Committee C-7—Subcommittee III—for lime for use in the manufacture of greases. It is expected that this poll will be completed by December 1st.

The Panel on Delivery Characteristics of Dispensing Equipment for Lubricating Greases has almost completed work on its exploratory program. The results reported to date indicate that so-called slumpability will, as expected, be a major factor as well as pumpability or rate of flow with the gun properly primed. As the packages were emptied, under the prescribed test conditions, the test greases did not slump or feed to the pumps satisfactorily. It is evident that in the next series of tests this factor must be given more attention and the test conditions may have to be changed appreciably.

To return to the annual meeting, it will be apparent that adoption of the projects listed above will lead to a considerable increase in the number of members who actively participate in Subcommittee activities. *It would be helpful if members particularly interested in any one of the new projects would write to the Chairman so that they may be considered at the time while the Subcommittees are in the process of being organized.*

3 EASY WAYS

Sell more by demonstrating an easier way to use your products



ADDS *ease to the handling —*

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- DIESEL FUEL
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- ALCOHOL
- GEAR LUBE
- MOTOR OIL
- KEROSENE
- *And Other Fluids*

NATIONAL . . .

TRAN-Z-FER

® Trademark

ALL PURPOSE PUMP

This pump is especially built for field use in filling tractors, trucks and other equipment. Also it is ideal for the transfer of most any fluid, including chassis and gear lubes, from any barrel with 2" bung to other containers. It is expertly machined and finished. Comes packed in individual cartons with 8-ft. of low-pressure, oil-resistant hose; equipped with 9" non-drip nozzle.

EASY APPLICATION SELLS LUBRICANTS

The Gre-Zer-Ator gives super service station performance to the individual . . . made for one-hand operation. No air or electric connections; hydraulic booster develops 5000 lbs. pressure. Fits all standard 25- to 40-lb. pails. *One demonstration sells gun and grease.*

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NATIONAL

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NATIONAL SALES, INC.

TO SELL — LUBRICANTS

The Most Economical Gear Lube Dispensing Unit Ever Introduced . . . efficient . . . fast . . . clean

NATIONAL . . .

GEAR-GRE-ZOR

Trademark

3 STROKES... 1 POUND

Simple to assemble — easy to use . . . that's why the Gear-Gre-Zor sells on sight . . . and it's so economical the user will want one for each grade of lubricant. . . . Industrial plants can use several. Made of rust-proof steel and cast aluminum . . . 5 feet of sturdy hose . . . fits all standard 25- or 40-lb. lug cover pails. Recommended for use with SAE 80-90-140 gear lubes.

A sure-fire sales promotion item that will help you sell more gear lubricants.

812 NORTH MAIN — WICHITA, KANSAS

Effect of INORGANIC FILLERS in Greases on *WEAR* of Anti-Friction Bearings

by C. W. GEORGI

Enterprise Oil Company, Inc.
Quaker State Oil Refining Corp.

PRACTICALLY all published recommendations for the grease lubrication of anti-friction bearings specify the lubricant must contain no inorganic fillers and must have very low total non-oleaginous insoluble matter. Consumer specifications for bearing greases similarly contain typical requirements such as:

INORGANIC FILLERS—Nil
INSOLUBE MATTER—
0.1% maximum

In spite of this almost universal ban on fillers and insoluble matter in bearing greases, lubricants containing asbestos floats, graphite, carbon black, zinc oxide, and a variety of other similar fillers have been manufactured and utilized in considerable volumes for many years. The utilization of such "filled" greases, apparently with satisfactory performance in many applications, raises the academic question as to whether all fillers as a class are undesirable, or whether the prevalent belief that such materials are violently abrasive is to some extent at least a popular fallacy. This question has become of increasing interest in view of compartively recent developments in greases containing high percentages of carbon black and which have certain interesting properties. A similar new development, which apparently originated in Germany during the war, and which has since aroused some interest in the United States, comprises thickening of oils to grease consistency by means of finely divided silica. Such silica base greases can be made with very high melting points, and remarkably low rates of consistency change with temperature or severe working.

At any rate, greases containing fillers are articles of commerce, and must be regarded as one phase of grease lubrication. Since bearing wear is one of the major limitations in considering "filled" greases, a wear test investigation was undertaken to explore this factor. While the results are by no means sufficiently comprehensive to be complete or final, they appear to be of sufficient general interest to warrant publication.

Bearing Wear Test Procedure

Figure 1 is a cross section drawing of the wear test apparatus used in this work. It consists essentially of a belt driven fixture which holds the test bearing, either a ¾" bore taper roller bearing or a 20 m.m. bore ball bearing, by changing the shaft diamater. As the result of experience with several unsatisfactory wear test devices, the test bearing is mounted vertically to eliminate variables in adjustment or alignment and the loading is essentially thrust, which seems to aggravate potential wear tendencies of lubricants. Test speed and thrust load may be varied as desired by selection of the proper belt drive ratio and of the weight applied by the lever.

In conducting a test, a new bearing is carefully cleaned with solvents, dried and weighed on an analytical balance. It is then placed in the cup of the test fixture, packed with the desired lubricant and run under the selected conditions of speed, load and time. Following the test run, the bearing is again carefully cleaned to constant weight and the weight loss determined.

Bearing Wear Test Results

Figure 2 shows a typical group of wear test results. With non-abrasive lubricants, such as motor oil or conventional soap-oil greases, bearing wear as indicated by weight loss is of very small magnitude, but may vary over an appreciable range from bearing to bearing. The highest rate of weight loss develops in the first few hours of running, due probably to removal of "fuzz" from the green bearings. Following this initial run-in, weight loss with continued operation proceeds at a much lower rate. In general, weight losses of less than .010 grams in 200 hours of test operation can be considered as normal for non-abrasive lubricants with either the taper roller or ball bearings of the particular size utilized.

Figure 2 also shows typical results with greases containing fillers

FIGURE 2

TYPICAL BEARING WEAR TEST RESULTS

(Taper Roller Bearings)

SPEED: 1000 R.P.M.
LOAD: 75% of Rated Thrust

LUBRICANT	Total Weight Loss in Grams	
	20 Hours	200 Hours
SAE 30 Motor Oil	.0032	.0033
	.0016	.0063
	.0045	.0093
Soda Base Bearing Grease	.0014	.0020
	.0041	.0050
	.0030	.0088
Plus 10% Graphite "A"	.0122	.0290
Plus 10% Graphite "B"	.508	....
Plus 10% Levigated Alumnia	4.20	....

(Continued to page 20)

Effect of Inorganic Fillers on Wear of Anti-Friction Bearings

(Continued from page 19)

of varying degrees of abrasiveness. The powdered graphite "A" may be classed as mildly abrasive and shows wear or weight loss some 3 to 10 times greater than non-abrasive lubricants. Powdered graphite "B" may be classed as actively abrasive, while the levigated alumina filler is violently abrasive and caused complete bearing failure in 20 test hours.

A detailed review of the large number of wear tests run during this program would be very lengthy and would add little to the more pertinent information developed. Certain basic findings can accordingly be summarized in brief as follows:

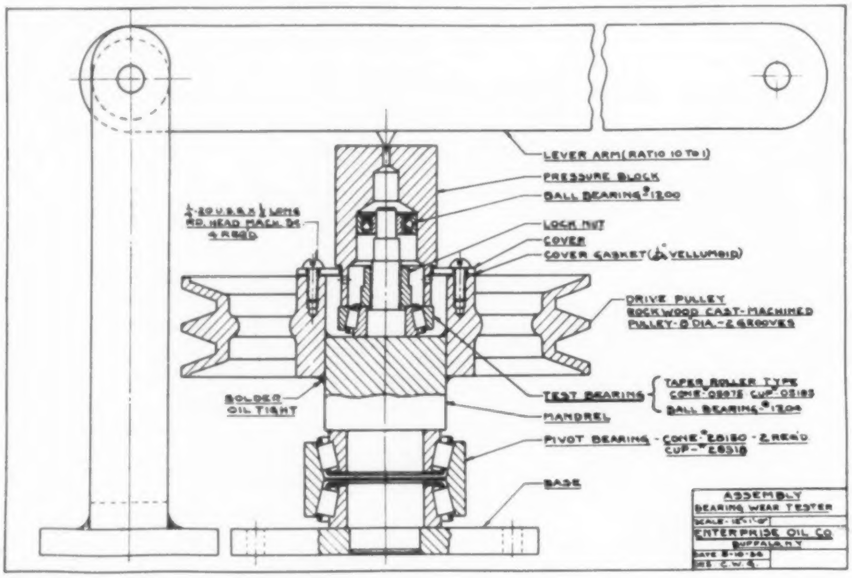
(1) Wear tests on either taper roller or ball bearings gave results of the same order and in very close agreement. Taper roller bearings were accordingly used in a major part of the tests since they were easier to clean and the condition of the cup and roller surfaces could be visually observed more readily.

(2) Test speeds ranging from 500 to 3600 R.P.M. apparently had little effect on wear results. Most of the test runs were therefore conducted at speeds in the order of 1000 R.P.M.

(3) Test loads ranging from 25% to 200% of rated thrust load apparently had little effect on the wear results. Tests at loads equal to 300% and 400% of rated thrust produced higher wear and in some instances failure of bearings. However, the higher wear and occasional failures at these loads occurred with mineral oil and with straight soap-oil greases and were evidently due to the gross over-loads and not to lubricant properties. Thrust loads of 75% rated capacity were accordingly used in most of the tests.

(4) Test times from a few up to several hundred hours indicated highest rates of weight loss or wear occurred during the first few test hours, and actively or violently abrasive lubricants could be detected with ease in 20 hours or less. Test periods of 150 to 200 hours or less abrasive or non-abrasive lubricants apparently furnished as significant comparative information as running for longer intervals.

During the course of the wear tests it was noted some of the lubricants containing "fillers" developed low wear losses in the range normal



for lubricating oils or straight soap-oil greases, but that distinct scratches and score lines were formed on the bearing races, balls and rollers, which was not normal for non-abrasive lubricants. Bearing No. 1 in Figure 3 shows a typical bearing race and cone from wear test run on a soda base bearing grease and illustrates the polished, unscratched bearing surfaces normal with a non-abrasive lubricant. Bearing No. 2 typifies the scratching and score lines developed in tests on certain "filled" lubricants, frequently with little or no greater weight loss than the normal level.

Bearing No. 3 in Figure 4 is typical of a test with an actively abrasive lubricant and illustrates the characteristic dull, abraded race and roller surfaces having a satin or matted finish. Bearing No. 4 is typical of a test on a violently abrasive lubricant and shows the severe scoring and wear which occurs. Note the rollers are badly worn down on the thrust loaded ends.

This experience with bearing wear tests has indicated that unsatisfactory lubrication insofar as abrasion is concerned may not necessarily be defined by weight losses alone and that the condition of the bearing surfaces may be taken as an added indication of abrasive tendencies. Accordingly, in reporting the results on the various types of inorganic fillers tested, the bearing surface condition is recorded on a numerical scale from 1 to 4, as per the illustrations in Figures 3 and 4; with a rating of 1 being good and 4 being very bad. Weight losses of .010 grams and less are reported as "Normal", while higher losses indicative of abrasion are reported as "Mild", "Active", or "Violent", rather than in numerical values.

Figure 5 summarizes wear test results on a representative soda base bearing grease compounded with several different fillers as quite commonly used in grease formulations. The commercial graphite powders may be classified as mildly to actively abrasive, while the colloidal graphite in concentration of approximately 1% is indicated to be substantially non-abrasive. Similarly, typical commercial carbon blacks range from mildly abrasive to non-abrasive, depending upon the particular product, probably as related to the degree of purity and freedom from extraneous abrasive matter.

FIGURE 3

Bearing No. 1 — Bearing No. 2

FIGURE 4

Bearing No. 3 — Bearing No. 4

FIGURE 5

BEARING WEAR TESTS

SODA BASE GREASE CONTAINING:	Abrasiveness As Indicated By:	
	Weight Loss	Brg. Surface Condition
10% Graphite "B"	Active	No. 3
10% Graphite "A"	Mild	No. 2½
10% Graphite "C"	Mild	No. 2
1% Colloidal Graphite	Normal	No. 1
10% Channel Black "A"	Mild	No. 1½
10% Channel Black "B"	Normal	No. 1
10% Furnace Black "A"	Mild	No. 1½
10% Furnace Black "B"	Normal	No. 1

Figure 6 summarizes tests on another group of fillers, some of which are used occasionally in greases. Of this series only the one grade of sulfur is indicated to be non-abrasive, and the other fillers range upwards to violent abrasiveness. Although some of these fillers caused little weight loss, scratching and scoring of the bearing surfaces was developed, which places them in the questionable class.

FIGURE 6

BEARING WEAR TESTS

SODA BASE GREASE CONTAINING:	Abrasiveness as Indicated By:	
	Weight Loss	Brg. Surface Condition
10% Asbestos "A"	Violent	No. 4
10% Asbestos "B"	Active	No. 3
10% Flake Mica	Normal	No. 1½
10% Bentonite	Normal	No. 1½
10% Sulfur Flour "A"	Normal	No. 1½
10% Sulfur Flour "B"	Normal	No.1

Figure 7 summarizes tests on a series of metal salts, which are available in the form of finely divided powders and having in varying degrees a slippery or greasy feeling. Certain of these have been used to some extent in greases and others have been mentioned for such use in patents and technical literature. Of this group of fillers, only calcium silicate and antimony pentasulfide can be rated as non-abrasive.

Figure 8 lists test results on several lead compounds. Filled greases containing powdered lead or lead salts are not common, although a few such formulations are apparently on the market. While the first three lead salts listed can be rated as hav-

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Effect of Inorganic Fillers on Wear of Anti-Friction Bearings

(Continued from page 21)

ing abrasive tendencies, the last four are indicated to be substantially non-abrasive.

FIGURE 7

BEARING WEAR TESTS

SODA BASE GREASE CONTAINING:	Abrasiveness As Indicated By:	
	Weight Loss	Brg. Surface Condition
10% Barium Sulfate	Mild	No. 1.5
10% Calcium Carbonate	Normal	No. 1.5
10% Calcium Silicate	Normal	No. 1
10% Magnesium Silicate	Normal	No. 1.5
10% Mg. Al. Silicate	Normal	No. 1.5
10% Antimony Trisulfide	Mild	No. 2.0
10% Antimony Pentasulfide	Normal	No. 1.0
10% Zinc Oxide "A"	Mild	No. 1.5
10% Zinc Oxide "B"	Normal	No. 1.5

The tendency of inorganic fillers to cause abrasion appears to be a function of both particle size and hardness. Obviously the harder the particle, the more it will tend to abrade or score metal bearing surfaces. It seems, however, that particle size is also of considerable significance. Figure 9 shows results of tests on three aluminum oxides of different types. The levigated alumina of 5 to 10 microns particle size, and which is used for metal polishing because of its hardness, is violently abrasive to bearings. The floated alumina of 1/10 micron particle size, is significantly less abrasive, although particle hardness is very similar. On the other hand, the hydrated alumina, comprising much softer particles of considerably larger size is indicated to be substantially non-abrasive.

FIGURE 8

BEARING WEAR TESTS

SODA BASE GREASE CONTAINING:	Abrasiveness As Indicated By:	
	Weight Loss	Brg. Surface Condition
10% Red Lead	Mild	No. 1.5
10% Lead Oxide	Mild	No. 1.5
10% Lead Carbonate	Normal	No. 1.5
10% Basic Lead Carbonate	Normal	No. 1
10% Lead Sulfide	Normal	No. 1
10% Lead Sulfate	Normal	No. 1
10% Powdered Lead Metal	Normal	No. 1

FIGURE 9

BEARING WEAR TESTS

SODA BASE GREASE CONTAINING:	Abrasiveness As Indicated By:	
	Weight Loss	Brg. Surface Condition
10% Levigated Alumina (5/10 Microns Particle Size)	Violent	No. 4
10% Floated Alumina (0.1 Micron Particle Size)	Mild	No. 3
10% Hydrated Alumina (Over 10 Microns Particle Size)	Normal	No. 1

The relation of particle size to potential abrasivenes is further illustrated in Figure 10, which summarizes tests on a variety of silica powders. Since some of these silicas convert fluid oils to grease-like gels, this test series was conducted on mixtures of the respective powders in SAE 30 motor oil.

All of these silicas may be considered as having similar particle hardness, yet their respective abrasive tendencies vary widely. The relatively coarse silica powder is violently abrasive, but there is a progressive decrease in abrasive action with decreasing particle size, and two of the very fine silicas are indicated to be substantially non-abrasive. The silicic acid, on the other hand, evidences abrasive tendencies.

FIGURE 10

BEARING WEAR TESTS

SAE 30 MOTOR OIL CONTAINING:	Abrasiveness As Indicated By:	
	Weight Loss	Brg. Surface Condition
10% 200 Mesh Silica Powder	Violent	4
10% Silica Powder "A" (over 10 Microns)	Active	2
10% Silica Powder "B"	Mild	2
10% Silica Powder "C" (3/5 Microns)	Normal	1
10% Silica Powder "D" (.5 Microns Max.)	Normal	1
10% Silicic Acid	Normal	1.5

(Continued to page 24)

Effect of Inorganic Fillers on Wear of Anti-Friction Bearings

(Continued from page 23)

Conclusion

In presenting a paper on the controversial subject of wear and abrasion, the greatest danger lies in possibilities of misunderstanding or misinterpretation of the subject matter. It is necessary therefore to emphasize certain conclusions:

(1) It is not the intent of this paper to advocate use of greases or lubricants containing non-oleaginous fillers. Neither is it intended to imply that fillers are necessarily beneficial or desirable.

(2) It is more the purpose of this paper to call attention to the fact mere presence of inorganic solids in greases or lubricants does not necessarily mean such is dangerous or undesirable. Certain types of fillers are indicated to be substantially non-abrasive to bearings, and some of these materials are also indicated to impart properties to lubricant compositions which are not readily obtainable by other means.

(3) Anti-friction bearings appear to be considerably more resistant or tolerant to solid particles than is commonly realized. Bearings can apparently tolerate without damage particles of relatively large size, provided they are soft in character; or particles of very hard nature provided they are of sufficiently small size.

(4) Lastly, since so little is known concerning the physical mechanisms of lubrication, wear and abrasion, it is hoped this paper may stimulate more thinking on the subject.

President's Column

by B. G. Symon, President N.L.G.I.

All of us have made New Year's resolutions at one time or another—perhaps we have sworn never again to mix gin, scotch or rye, or never again to give 20 points in a bet on the Army-Navy game, or never to neglect to phone our "better half" when we are going to be late for dinner.

Taking stock of ourselves at the start of each year is a healthy proceeding and this holds true for the National Lubricating Grease Institute, and for us as individuals. A new year provides a natural breaking-off point in the inevitable rush of events. It is a time for reflection, for review, and for training sights anew on goals not yet attained. It is a time to ask ourselves such questions as the following:

1. Is the National Lubricating Grease Institute doing everything it can for its members within the scope of its constitution and by-laws?

2. Is the "Institute Spokesman" as good as it could be?

3. Are we, as an industry, making satisfactory technological progress?

4. Are we, as an industry, constantly endeavoring to make better greases and to develop new uses for them?

As we see it, the twelve months ahead are 365 days of opportunity and there is no better time for self analysis than at the start of the new year because this traditionally means a chance for a fresh start and opportunity to knock again on fortune's door.

And so I give you a toast for 1949:

May it mark new channels in research that will enable greases to occupy a still more important place in the field of quality lubricants.

May it turn up new uses for our products that will permit the industry to grow and give better service than ever to the public.

May it create new ideas for the "Institute Spokesman".

May it witness a new era of harmony in Management-Employee relationship.

May 1949 be a prosperous year for everyone.

In conclusion, let us add that it is a pleasure to lay aside the everyday routine and in real sincerity wish our friends and associates a Very Happy New Year. Therefore, we herewith extend to you and yours our best wishes for good health and happiness during the coming year.

MEETINGS *of Your Industry*

JANUARY . . . 1949

10-14 American Socy. of Mechanical Engineers, Materials Handling, joint with Management Division (includes exhibit); Convention Hall, Philadelphia, Pa.

10-14 Socy. of Automotive Engineers (annual meeting); Book-Cadillac Hotel, Detroit, Mich.

18 Oil Trades Assn. of New York; Waldorf-Astoria, New York, N. Y.

20-21 American Management Assn. (Finance); Hotel Pennsylvania, New York, N. Y.

26-27 Northwest Petroleum Assn.; Hotel Nicolett, Minneapolis, Minn.

27 Socy. of Automotive Engineers (fuels and lubricants); Engineering Societies Bldg, New York, N. Y.

FEBRUARY

14-16 American Management Assn. (personnel); Palmer House, Chicago, Ill.

Feb. 28-Mar. 4 American Socy. for Testing Materials (spring meeting and ASTM committee week); Edgewater Beach Hotel, Chicago, Ill.

MARCH

1-2 Wisconsin Petroleum Assn. (annual convention); Schroeder Hotel, Milwaukee, Wisc.

3 Socy. of Automotive Engineers (air transport); Engineering Societies Bldg., New York, N. Y.

6-8 Southern Safety Conference and Exposition; Hillsboro Hotel, Tampa, Fla.

6-10 American Inst. of Chemical Engineers (regional meeting); Los Angeles, Calif.

9-11 American Socy. of Automotive Engineers, passenger-car division; Book-Cadillac Hotel, Detroit, Mich.

9-11 American Petroleum Institute (Division of Production, Southwestern District); Galvez Hotel, Galveston, Texas.

14-17 American Assn. of Petroleum Geologists (regional meeting); Jefferson Hotel, St. Louis, Mo.

14-17 Socy. of Exploration Geophysicists; Jefferson Hotel, St. Louis, Mo.

14-17 Socy. of Economic Paleontologists and Mineralogists; Jefferson Hotel, St. Louis, Mo.

15 Oil Trades Assn. of New York; Waldorf-Astoria, New York, N. Y.

17-18 American Management Assn. (marketing); Hotel Pennsylvania, New York, N. Y.

23-25 American Petroleum Institute (Division of Production, Mid Continent District); Mayo Hotel, Tulsa, Okla.

24 Socy. of Automotive Engineers (aeronautics); Engineering Societies Bldg., New York, N. Y.

28-30 American Socy. of Automotive Engineers, transportation division; Statler Hotel, Cleveland, Ohio.

28-30 Western Petroleum Refiners Assn.; Plaza Hotel, Cleveland, Ohio.

29-31 Ohio Petroleum Marketers Assn.; Deshler-Wallick, Columbus, Ohio.

29-April 1 19th Annual Safety Assn.; Statler Hotel, Boston, Mass.

29-April 1 Greater New York Safety Council; Hotel Pennsylvania, New York, N. Y.

30 National Farm Chemurgic Council, Inc.; Hotel Peabody, Memphis, Tenn.

APRIL

4-5 Industrial Accident Prevention Assn. (convention); Royal York Hotel, Toronto, Canada.

11-13 Socy. of Automotive Engineers, aeronautic and air-transportation division; Hotel New Yorker, New York, N. Y.

11-13 American Socy. of Lubrication Engineers (annual meeting); Pennsylvania Hotel, New York, N. Y.

13-15 National Petroleum Assn.; Hotel Cleveland, Cleveland, Ohio.

14-15 American Management Assn. (production); Hotel Pennsylvania, New York, N. Y.

18-20 Midwest Power Conference (11th annual meeting); Hotel Sherman, Chicago, Ill.

20-22 American Geophysical Union (annual meeting); National Museum, Washington, D. C.

20-22 Natural Gasoline Assn. of America (annual convention); Texas Hotel, Fort Worth, Texas.

22 The Maryland Utilities Assn. (annual meeting); Lord Baltimore Hotel, Baltimore, Md.

25-28 Southern Machinery and Metals Exposition; Atlanta, Ga.

27-29 American Petroleum Institute (Division of Production, Eastern District); William Penn Hotel, Pittsburgh, Pa.

28 Socy. of Automotive Engineers, Engineering Societies Bldg., New York, N. Y.

MAY

2-4 Independent Petroleum Assn. of America (mid-year directors meeting); New Orleans, La.

2-4 The American Socy. of Mechanical Engineers (spring meeting); New London, Conn.

8-12 American Institute of Chemical Engineers (regional meeting); Tulsa, Okla.

10-12 American Management Assn. (packaging); Auditorium, Atlantic City, N. J.

12-13 American Petroleum Institute (Division of Production, Pacific Coast District); Biltmore Hotel, Los Angeles, Calif.

26 Socy. of Automotive Engineers (diesel engine); Engineering Societies Bldg., New York, N. Y.

26-27 The Natural Gas and Petroleum Assn. of Canada (annual meeting); Hotel London, London, Ont., Canada.

26-27 American Petroleum Institute (Division of Production, Rocky Mountain District); Gladstone Hotel, Casper, Wyo.

JUNE

5-10 Socy. of Automotive Engineers (summer meeting); To be determined.

27-30 The American Socy. of Mechanical Engineers (semi-annual meeting); San Francisco, Calif.

27-July 1 American Socy. for Testing Materials (52nd annual meeting); Haddon Hall, Hotel Chalfont, Atlantic City, N. J.

SEPTEMBER

14-16 National Petroleum Assn.; Hotel Traymore, Atlantic City, N. J.

16-17 The Maryland Utilities Assn. (fall conference); Cavalier Hotel, Virginia Beach, Va.

18-20 American Inst. of Chemical Engineers; Mt. Royal Hotel, Montreal, Canada.

28-30 The American Socy. of Mechanical Engineers (fall meeting); Erie, Pa.

OCTOBER

3-5 **National Lubricating Grease Institute, Roosevelt Hotel, New Orleans, La.**

10-14 American Socy. for Testing Materials (West Coast meeting), Fairmont Hotel, San Francisco, Calif.

13-14 Indiana Independent Petroleum Assn. (fall convention); Hotel Severin, Indianapolis, Ind.

31 to Nov. 4 National Safety Council Congress; Morrison Hotel, Chicago, Ill.

NOVEMBER

1-5 Pacific Chemical Exposition; Civic Auditorium, San Francisco, Calif.

7-10 American Inst. of Chemical Engineers; Hotel William Penn, Pittsburgh, Pa.

27 to Dec. 2 American Socy. of Mechanical Engineers (annual meeting); New York, N. Y.

DECEMBER

2-3 American Management Assn. (insurance division); Hotel Drake, Chicago, Ill.

AMERICAN BUSINESS • *Distributor of Wealth*

DURING the First World War and to a greater extent during and following the recent conflict; we Americans have slowly learned that there are other places on this globe possessing greater natural resources than our own country. A quick trip to your local library or Department of Commerce will easily disclose the amazing fact that prior to World War II, other nations boasted a per capita wealth not too far below our own. In fact, it was sufficiently close to have permitted their people to enjoy the comforts of a life not unlike our own.

But we know this did not happen. Other nations possessing a high per-capita wealth continued life without presenting their citizens with the comforts of life as we know and cherish them here in our United States. Still others, possessing practically all our natural resources plus many we do not possess, lived in abject poverty with starvation the constant lot of the majority.

What Is Wealth?

People throughout the world, and most of our own people for that matter, believe our high standard of life has been entirely due to our abundant natural resources. We and other nations point to our comfortable homes, automobiles, hospitals, warm clothing, abundant food, beautiful highways and superb railroads. We point and exclaim, "This is all due to abundant natural resources and a fat land capable of producing food for the world."

Quite right, we are the richest nation in the world—if we consider wealth as a high standard of living for all our people. Consider us from the standpoint of resources and not from the standpoint of what our people individually possess, and we are not the richest land in the world.

That is the difference between ourselves and other nations. We have learned to consider wealth as a blessing we all can share. A quick look at the dismal picture presented by other nations is sufficient to convince us that no nation in the world has learned how to convert its visible and hidden wealth to the good of its people as has this nation.

Admittedly, in many cases, they have some natural resources in greater abundance than our own; and in other cases they have all types of natural resources in greater abundance than our own—plus resources which are unknown to our land. Then why do our people enjoy the best that there is in life; and the people of these nations cherish a morsel of bread, a pair of tattered shoes, a piece of wood or shovel of coal, as we might consider a turkey dinner, a tailor made suit of clothing or the latest model of air conditioning system for our homes?

"Enterprise" Not the Answer

In the past we have glibly attributed our bountiful living to that nebulous term, "American Enterprise." But it is not American Enterprise that has produced all that is American in progress and comfort. Of course it required enterprise to drill the first oil well in this country. But that is not the important point. Getting oil out of the ground is not new. Putting it to work for the benefit of all people was new.

American Business for Benefit of All

I think you will find in comparing our nation with others our primary difference has been that we have known how to put our natural resources and land to work for the benefit of the greatest number of people. That is the point where American business, and not particularly American enterprise, stepped into the picture.

It was American business that drilled the first oil well. But oil, whether it flowed from a well or oozed from the ground, was of no value unless it could be converted into usable products. The subsequent story is too well-known to be repeated. We all know that American business did convert crude oil into a host of products that finally made modern America the wonderland of history.

The "American Touch"

Getting oil from the ground and converting it to usable products was not enough for our businessmen. There still remained the final touch. Let's call it the "American touch".

What is this final touch? We all know it so well, that we have forgotten to recognize it. It is that peculiar American ability to produce products at such a low price that all people can enjoy them. That was the third, and final gift we have received from American business.

Telling and Educating

There is one final phase of our business world we all know very well. We call it "advertising". This is another peculiarity of our economic system. It has meant much more to all of us than a cunning attempt to entice us into buying something we didn't want in the first place. This business tool has been consistently used to tell us that a

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(Continued from page 27)

product is available for our use; and then has gone about telling us how to use it. Advertising brought about mass demand. This meant mass production. The final story was low prices, high wages, with the bulk of our people living in a luxury unknown and undreamed of by the rest of our modern world.

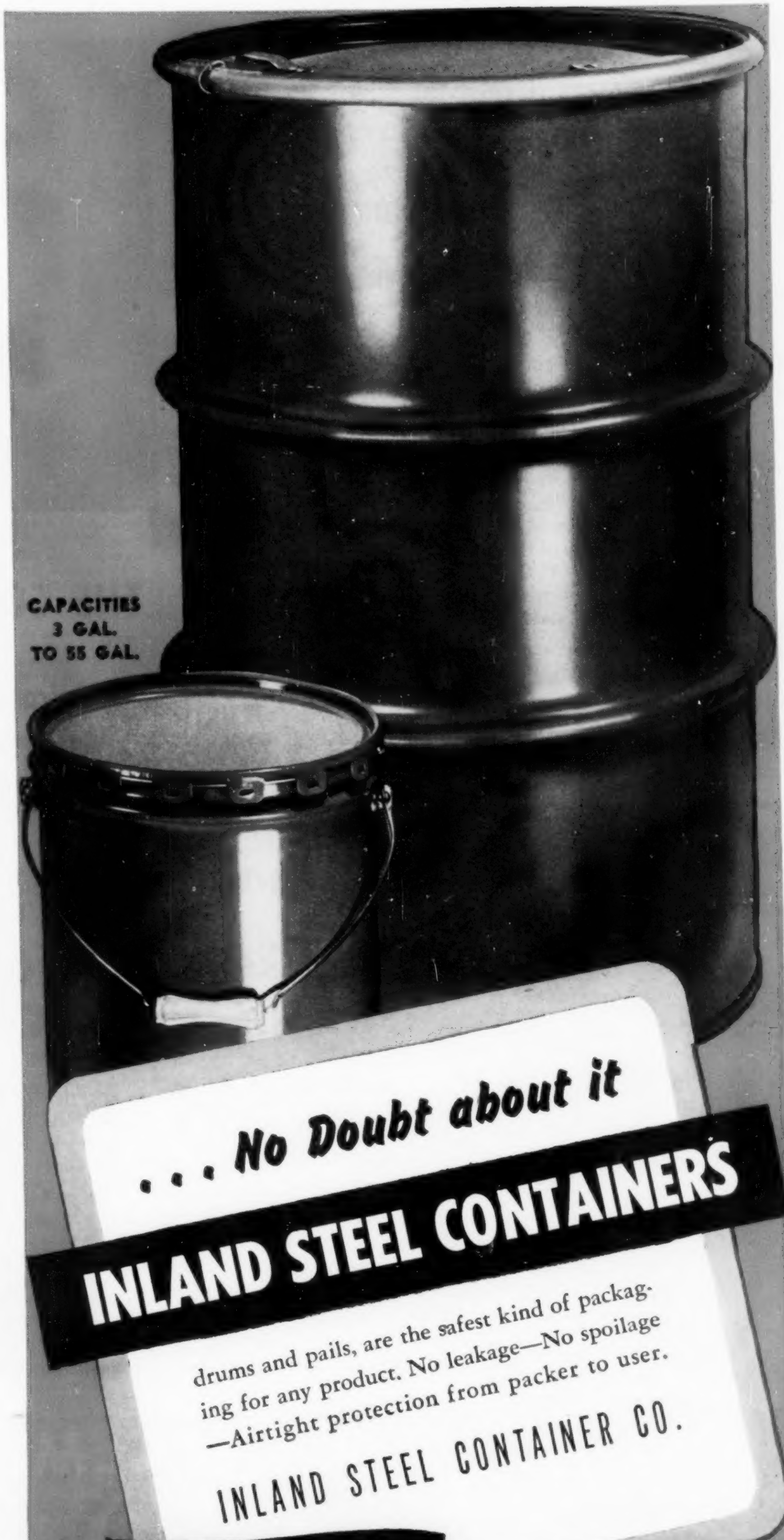
Primary Aim of Business

The primary aim of American business has always been to produce, and then make a market for this production. Many of us have too often looked upon this effort of making a market as a selfish business term meaning "to make people buy something they do not really want". Actually the term, "making a market", is a peculiarity of American life and of American business in particular. It means educating a great mass of people to use a product in the proper manner, and then producing it at a price the majority of them can afford.

Business Distributes Wealth

We have all thought of our business system, and our businessmen, as producers and not distributors. Actually, they are the greatest distributors of wealth the world has ever witnessed. From time to time various political systems have mushroomed on the one premise that the leaders will redistribute wealth to all. Our American business system has been doing this for so long that we have forgotten that this is the only nation in the world whose citizens enjoy so much individual wealth. Our wealth has been widely distributed among us in the forms of automobiles, modern homes, refrigerators, electric lights, and a vast array of other items so necessary to all of us. This has been done because our own American businessman has found a way to place wealth in our hands.

I think that if you will consider the fundamental difference between our great nation, and the nations of other peoples, you will not find that difference in the people, their political systems or other attributes peculiar to them. You will find it in the fact that they have never developed a true business system dedicated to the enrichment of all—and we have.



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